Space Weather Technical Forecast

Issued on Sunday, 29 January 2023 at 12:27 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of R1/R2 Radio Blackouts. Slight chance of G1/Minor Storm Days 3-4 (30 Jan-01 Feb). Slight chance of Active fluence later in the period.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Low with isolated C-class flares, the largest a C3 peaking at 28/1201 UTC from AR3200 in the northwest. There are currently six sunspot regions on the visible disc, all of which appear small, weak and magnetically simple. One of these is a new region emerging near the southeast limb which is difficult to see at present due to the viewing angle, but appears small and simple so far.
No Earth-directed CMEs were seen in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1 by DSCOVR, shows that Earth is in a High Speed Stream (HSS), likely from CH71/+. Wind speed was mostly elevated, varying between 470-570 km/s. Density remains at average or slightly above average levels. The total IMF, Bt, was weak at 5nT or below. The north-south component, Bz, also varied weakly between +5/-4nT. The phi angle was positive (away from the Sun) but started to vary after 29/0000 UTC. Geomagnetic Activity was Quiet to Unsettled (Kp 0-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has been at background levels throughout. High energy electron flux (greater than 2 MeV) has been at background to moderate levels, peaking at 589pfu at 28/1825UTC. The associated 24-hour integrated electron fluence has drifted upwards but remains well below the Active threshold, with 1.34e7 integrated pfu observed at 29/0001 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to be predominantly Low, with a slight chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are expected during this period. Earth is currently experiencing a HSS which is just starting to wane. Wind speeds are expected to slowly decline through the next couple of days, likely to ambient levels. A further pair of negative polarity coronal holes are likely to bring an increase in wind speeds later in the period. The timing of this is somewhat uncertain at present, but the most likely arrival time is considered to be sometime during Day 4 (01 Feb), with low confidence.
Geomagnetic activity is expected to be Quiet to Unsettled (Kp 0-3) for much of the period. Either on Day 3 or 4 (30 Jan-01 Feb), activity is likely to increase slightly with a chance of Active (Kp 4) intervals, and a slight chance of isolated G1/Minor Storm (Kp 5) intervals when the HSS arrives.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES16 is expected to remain at background levels. Electron flux may increase through the period as the HSS wanes. Fluence may also show an increasing trend over the next couple of days, with a slight chance of reaching the Active (1e8 integrated pfu) threshold, although this is low confidence.

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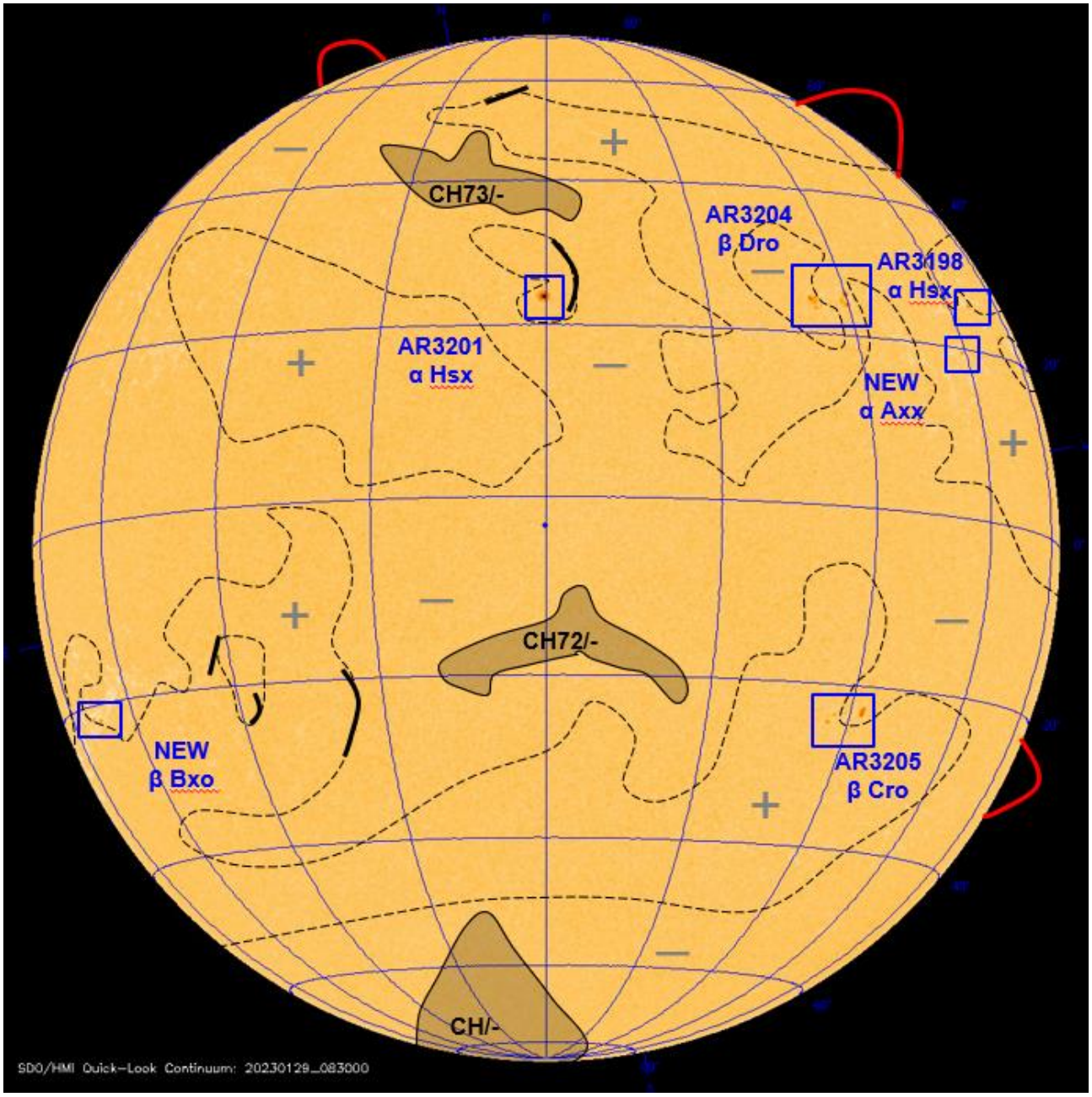
Figure 1. Solar Analysis Valid 29/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

No Earth-directed CMEs are currently expected during this period.

Earth is currently experiencing a HSS, most likely from CH71/+, which is just starting to wane. Wind speeds are expected to slowly decline through the next couple of days, likely to ambient levels as seen recently at STEREO-A. A further pair of negative polarity coronal holes, CH72 and CH73, are likely to bring an increase in wind speeds once again later in the period. The timing of this is somewhat uncertain at present, with Enlil and empirical methods suggesting an increase during Day 3 (31 Jan), but persistence would imply the increase won't occur until late Day 4 (01 Feb) or perhaps even early Day 5. As such, the most likely arrival time is considered to be sometime during Day 4, but with low confidence.

Geomagnetic activity is expected to be Quiet to Unsettled (Kp 0-3) for much of the period. Either on Day 3 or 4, activity is likely to increase slightly with a chance of Active (Kp 4) intervals, and a slight chance of isolated G1/Minor Storm (Kp 5) intervals when the HSS arrives.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	10	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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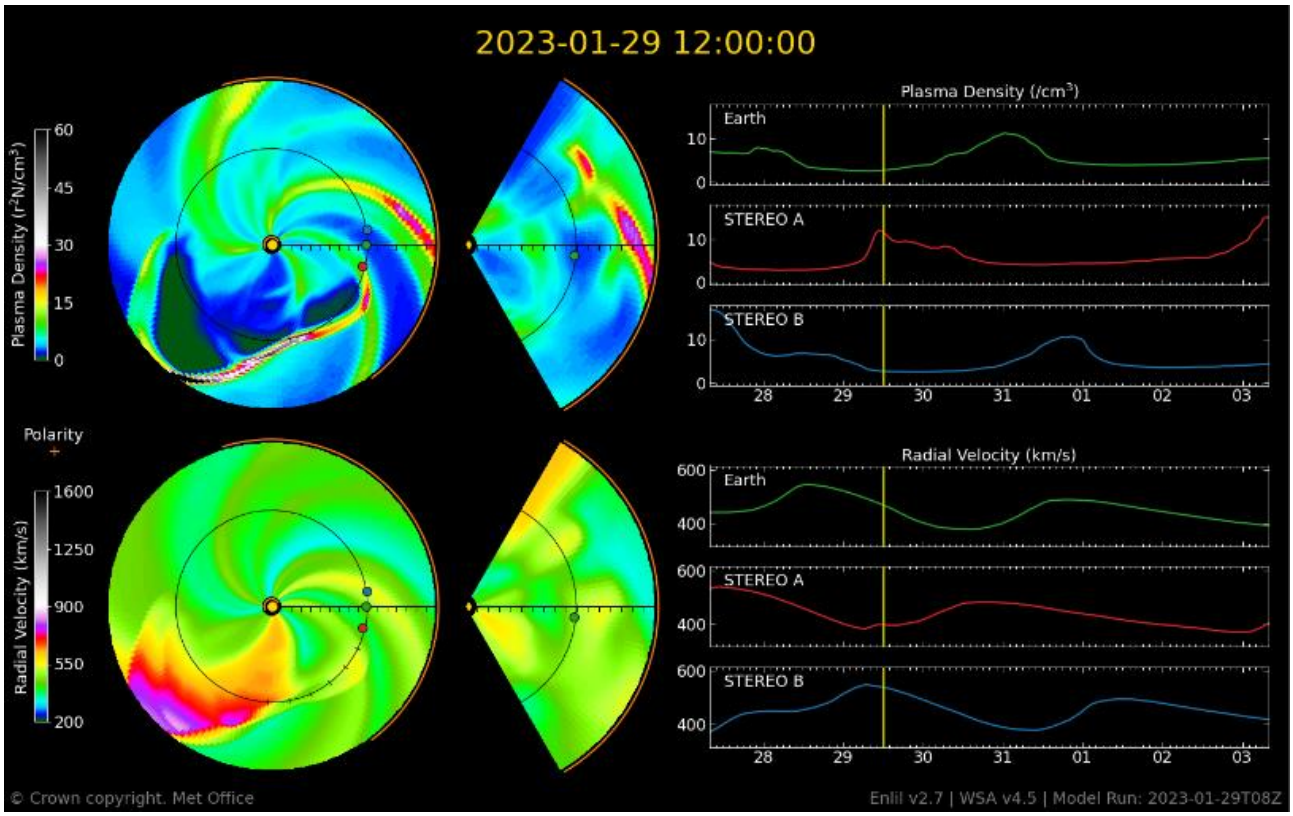
Figure 2: MOSWOC Enlil showing a decline in wind speeds through today and tomorrow, before an increase on the 31st January. Enlil is likely to be a little too early with this increase, which is perhaps more likely on the 1st February.



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Radio Blackouts - X-Ray Flares:

Solar activity has been Low with isolated C-class flares. There are currently six sunspot regions on the visible disc, all of which are small, weak and magnetically simple. One of these is a new region which has emerged around the southeast limb, which also currently appears small and simple, but foreshortening makes it difficult to properly assess this at the moment. A further area of bright flux is visible in STEREO-A EUV imagery, suggesting there may be more to follow around the southeast limb, however.

Solar activity is expected to be Low, with just a slight chance of an isolated M-class flare.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) proton flux as observed by GOES-16 is currently expected to persist at background levels. The current regions on the visible disc are all small and simple, and therefore unlikely to give any significant increase in proton counts.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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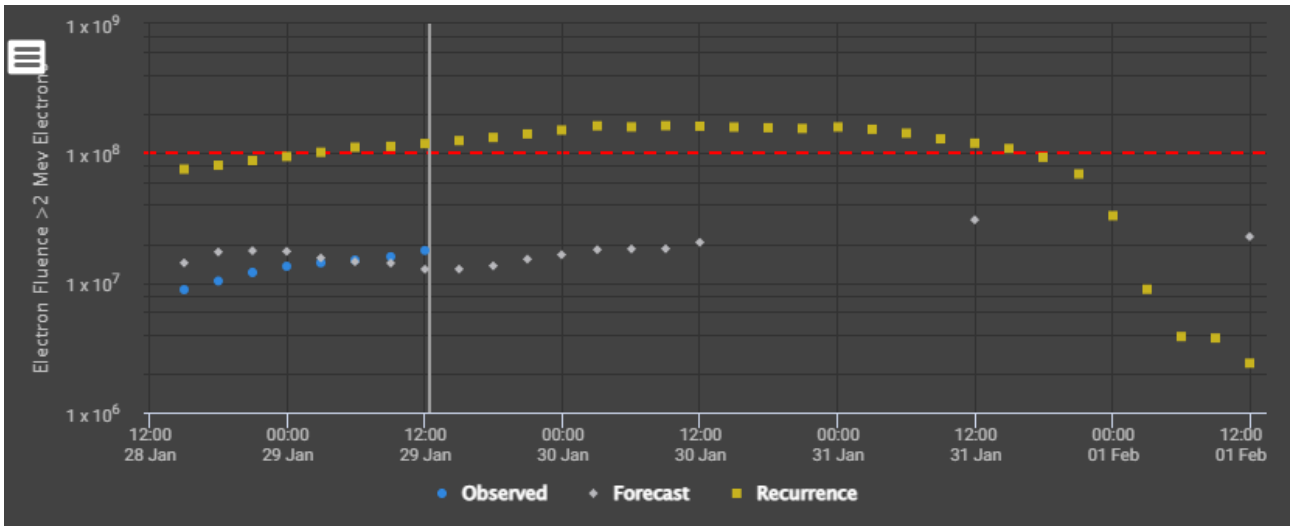
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2 MeV) is currently varying diurnally between background and moderate levels. This may show an increase as the HSS influence wanes and the radiation belts de-compress, although the level of any increase depends on how much charging has taken place during the current fast wind. The arrival of the next HSS later in the period is expected to suppress flux levels, although the timing of this arrival is low confidence (see geomagnetic storm section).

The associated 24 hour fluence may also show an increasing trend over the next couple of days with moderate confidence. There is a slight chance of reaching the Active (1e8 integrated pfu) threshold, although this is low confidence. REFM is currently forecasting a slight increase below Active up to Day 2 (30 Jan) which seems reasonable. Fluence did reach above Active on the previous rotation, but electron flux was higher at the equivalent of this point in time previously so levels are expected to be correspondingly lower this time around. A decrease is then possible towards the end of the period as the next HSS arrives.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	10	20	20
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: MOSWOC REFM showing a below Active forecast trend (white dots). Flux and fluence levels were higher on the previous rotation (yellow dots).



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